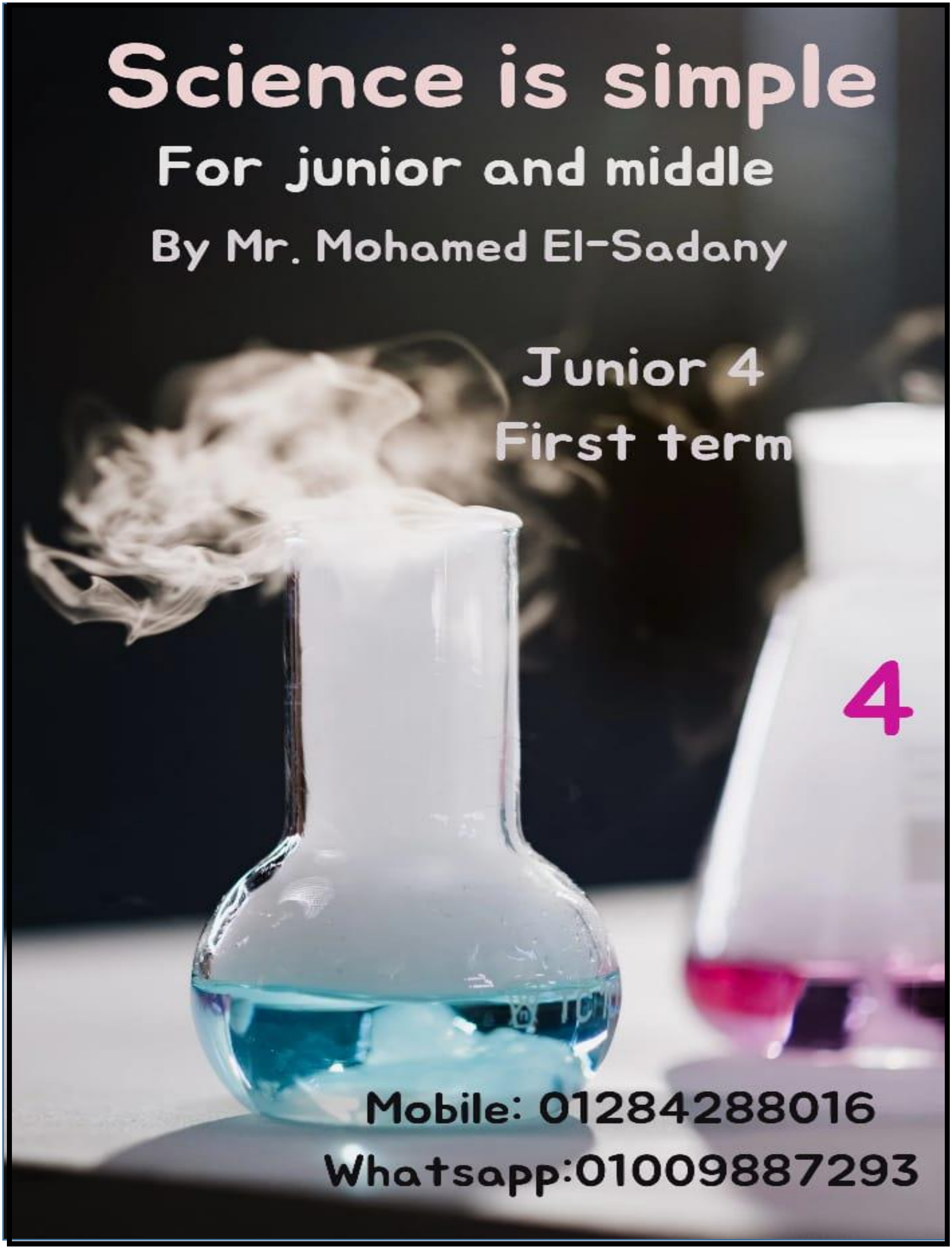


Science is simple

For junior and middle

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Junior 4

First term

4

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Adaptation

- Living organisms face some problems during life as the climate (cold or hot) and water amount.
- They must adapt with these changes to survive.

- in hot sunny day, organisms protect themselves by different ways: -



1- Starred agama lizard: - live in desert
- Keep itself cool by finding shaded area.

2- Palm leaves: covered with waxy layer to protect them.



3- Human being:
- using umbrella and light clothes.

Adaptation: some changes that help living organisms to survive and reproduce in the ecosystem.

- **ecosystem:** area that contain living and non-living things interact with each other.

Adaptation: تكيف face: يواجه climate: مناخ

Protect: يحمى survive :ينجو reproduce:يتكاثر



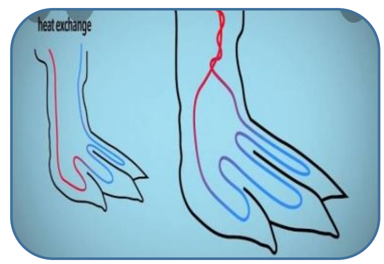
Adaptation in animals

1- Penguin

- Penguins live in Antarctica (very cold place).
- Penguin body has: -
  1. ***Insulating fat layer.***
  2. ***Thick feathers.***
- To keep its body warm. (trap warm air).

- Penguin feet have no feathers, but also don't freeze. G.R?

-Due to the way of blood movement (penguin feet have blood vessels).



- Cold blood moves up from feet to body.
- Warm blood moves down from body to feet.
- Warm vessels weave around cold ones to keep their feet warm.

Insulating: عازل **feathers:** ريش **layer:** طبقة **due to:** بسبب

Freeze: يتجمد **movement:** حرك **blood vessels:** أوعية دموية

Weave: تلتف keep: يحفظ trap: يحبس

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Camouflage

-***It's a way of adaptation in which: -***

- Organism use the color of surrounding to hide: -
- From predators: to not be hunted.
- from preys: to hunt them.



1) Polar bear: - (arctic or polar climate)

- It has ***white*** and ***thick*** fur. G.R?
- ***White*** to blend in with snow, ***Thick*** to keep its body warm.



2) Brown and dark bear: *-(forest)*

- they Have ***dark or brown fur*** to help them hide among trees during hunting.





3) Caracal and fennec fox: *-(desert)*

- They have **a *sandy colored fur*** to help them hide in desert.

4) Some types of lizards live in desert.



- They have ***colorful scales*** to make them hidden among rocks.

Camouflage: تمويه	**surrounding: البيئة المحيطة**	**hide: يختبئ**
predator: مفترس	**Prey: فريسة**	**thick: سميك**
among: بين	**forest: غابة**	**during:أثناء**
Scales: حراشيف	**sandy: رملى**	**caracal: قط برى**

2) types of adaptation

Structural (physical) adaptation: change in ***the structure*** of body help the organism to survive.

(body parts)

Examples: -

{sandy colored fur of fennec fox - blood vessels in penguin –teeth of cow}

Behavioral adaptation: change in the ***behavior*** of group of organisms to survive.

(animal's actions)

Examples: -

{panting – migration of birds at certain time}



- **Adaptation in animals: -**

1-Fennec fox: -it lives in hot and dry desert.

Structural adaptation	Behavioral adaptation
1. It has tan-colored fur: - To hide in desert. - To protect it from sun.	**1-*It pants like dogs*** - to cool its body
2. It has a large ear - to cool its body by losing heat.	**2- *It Live in burrows*** - to stay cool at day.
3. It has *special shape of ears* for good hearing sense. - **For hunting**	**3-*Eat different kinds of food*. G.R?** -because it's hard to find food in desert. **(*insects – fruit – roots – remains of prey)***

Structural: تركيبى behavioral: سلوكى burrows: شقوق

Panting: اللهث (take breath about 700 times per minute).



2-*Arctic fox:* live in tundra. (dry desert)

- Temperature (50°C below zero) in winter.

Structural adaptation	Behavioral adaptation
1. It has *thick fur* - **to** stay warm in cold climate. **2. His fur color changes by season** - ***White*** in winter - ***brown*** in summer	***1- Live in burrows*** - to stay warm at night.
3. It has a *short ears and legs* - to stay warm.	**2- *Eat different kinds of food*. G.R?** **-**because it's hard to find food in desert. **(*insects – fruit – roots – remains of prey)***
4. It has *special shape of ears* for good hearing sense.	

3- *Bull shark: -*



- Most sharks live only in salt water.
- Bull shark can live in both fresh and salt water, so it can find food easily in *fresh water* as there is no other sharks there.

Structural adaptation	Behavioral adaptation
1. Can live in fresh water.	***1-Eat different kinds of food*** As it lives in Fresh and salt water
2. It has a dark back and white belly - To hide from preys by camouflage strategy (countershading)	***2-Hunt at day and night.*** - So its prey cannot predict time of next attack.
3. It has sharp teeth: - - To cut its prey.	

Remains:بقايا bull shark: قرش الثور belly: بطن

Counter shading: تباين لونى predict: يتنبأ sharp:حادة

4-Panther chameleon. (tropical rain forest)



- **There are many types of lizard in different environments.**
- **Lizards from reptiles. Their body covered with scales**

Structural adaptation	Behavioral adaptation
1. It has *brightly colored scales.* - To hide among leaves and flowers.	- It doesn't have teeth or claws but in danger cases it can defend itself by: - **1- Blow its body with air.** **2- Open its mouth wide.** **3- Change the color of scales.** **-to** scare its enemies.
2. its eyes move in opposite directions. - *One eye search for food and the other eye looks out for danger.*	
3. It has *very long sticky tongue*. - For hunting	
4. V-shaped feet and tail like hand. To stick with branches and catch things	

3) adaptation in plants

- **plants grow every place sunlight can reach even in the bottom of sea.**
- **plants have structural and behavioral adaptation to survive in different environments.**

Panther chameleon: حرباء النمر reptiles: زواحف covered with: مغطى ب

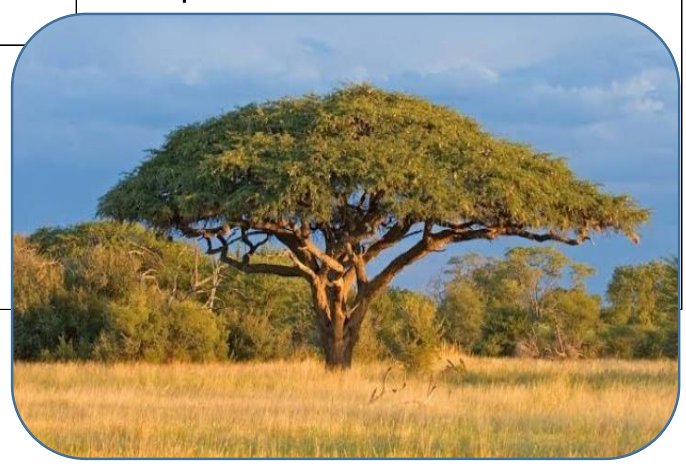
Bright: : لامع opposite: مقابل direction: اتجاه sticky: لاصق

Branches: فروع defend: يدافع bottom: قاع

1- Acacia tree. (umbrella shape)

- It grows in *savannah forest* in south Africa.
- Savannah forest is a *grassland* with *mild* temperature.
- It characterized by *lack* of water during dry season (last for 6 months).
  - Only acacia trees can be seen among grass. G.R?
  - Due to drought conditions.

Structural adaptation	Behavioral adaptation
1. Very long root (taproot) - Root extends deeply up to 35 meters search for water.	***1- Produce poison*** - that make leave`s taste very bad.
2. Very long trunk. - So animals can`t reach leaves except giraffe. - Store water as camel hump store fat.	**2- Send *smelly message* to warn another acacia trees to** produce the same poison.
3. *Tiny leaves.* To hold water and absorb sunlight. **4. *Sharp spines*** to protect it from animals.	



Acacia: شجرة السنط المظلى grassland: مراعى lack of water: نقص المياه taproot: جذر رئيسى

Drought: جفاف last for: يستمر لمدة mild temperature: حرارة معتدلة extend: يمتد

Trunk: جذع hump:سنام الجمل store: يخزن Spines: أشواك poison: سم

Warn: يحذر tiny: صغيرة Absorb: يمتص smelly message: رسالة ذات رائحة

2) kapok tree (umbrella shape)



- it grows in ***amazon rainforest in Brazil***.
- in amazon, it's easy to find water as it rains most of the year.
- it's hard for plants to reach ***sunlight.***
- there are ***soggy soil*** and ***strong wind***.
- trees grow up to ***70*** meters.



Structural adaptation	Behavioral adaptation
1. Large and wide roots (buttress roots) - Roots grow high on trunk up to 5 meters to hold the tree firmly.	1-It Sends *smelly message in air* to attract bats to help it in reproduction.
2. It has hand-shaped leaves. - To allow wind move gently through it.	2-It uses wind to carry its ***fluffy yellow seeds.***

- Plants differ in shape of their root, stem and leaves to adapt with the conditions of their environments.
- If the plant placed in different environment,
  - It may die or may adapt with the new conditions to survive.

Reach: يصل إلى soggy: طينية buttress roots: جذور داعمة

Firmly: بقوة attract: يجذب reproduction: تكاثر

Gently: برفق fluffy: رقيق conditions: ظروف

- ***Botanist***: the scientist who study plants.

Plant	Habitat	Adaptation	Help plant to: -
Mangrove.	**Salt water**	**Long and strong roots.**	**Resist strong waves.**
Waterlily.	**Wetland**	**Wide floating leaves.**	**Absorb a big amount of sunlight.**
Palm tree.	**desert**	**Thick root and small leaves.**	**Resist strong wind.**
Pine tree	**Snow**	**- Triangular shape.** **- Short branches.** **- Needle leaves.**	**- Allow snow slide.** **- Branches don't break** **- Prevent losing water.**
Barbary fig	**Desert**	**Sharp spines**	**- Prevent animal from eating leaves.**

Resist: يقاوم wide:عريض thick: سميك slide: ينزلق
Triangular: مثلث needle leaves: أوراق إبرية waterlily: اللوتس
Prevent: يمنع barbary fig: تين شوكى botanist: عالم النبات

4)Digestive system

- **The body is consisting of group of systems; each system has a specific function.**

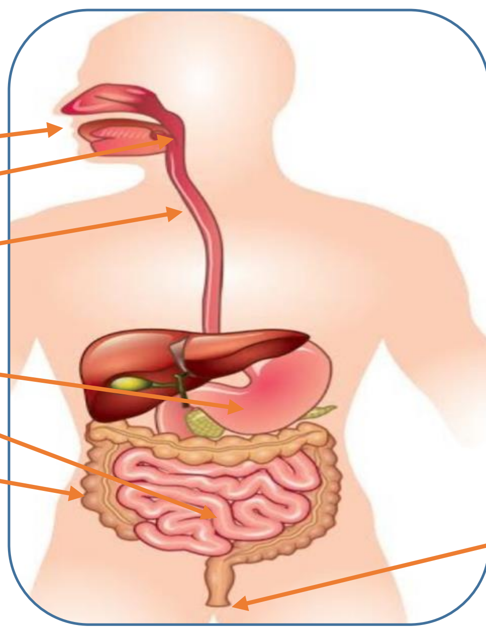
- **System is (*group of organs that working together to perform specific function*).**

- **We eat food to get energy.**
  - To do activities (walking – running and talking)
  - To do internal function (heart beats 100,000 times – thinking …).

- Digestive system and respiratory system are working together to get energy.

- **Digestive system: -**
  - The system responsible for breaking down food into small parts.
- **Digestion process: -**
  - **The process of breaking down food into small parts to be absorbed inside the body.**

- **Organs of digestive system: -**
  1. **Mouth**
  2. **throat**
  3. **Esophagus**
  4. **Stomach**
  5. **Small intestine**
  6. **Large intestine**



Consist of: يتكون من organs: أعضاء function: وظيفة perform: يؤدى

Throat: البلعوم esophagus: مرئ stomach: معدة small intestine: أمعاء دقيقة

Large intestine: أمعاء غليظة anus: فتحة الشرج responsible for: مسؤول عن

- Digestive system starts with ……………… and ends with ………………..

1- Mouth: contain teeth, tongue and saliva.

Teeth	Crush food during chewing.
Tongue	Mix food with saliva.
Saliva	- Help in digestion. - Facilitate swallowing (moistens food).

2- Esophagus:

- Long muscular tube used to transfer food from ***throat*** to ***stomach***.

3- Stomach:

- Muscular organ mix food with stomach acid and digestive juices.
- Food become soupy liquid inside stomach.
- Food stay inside stomach few hours then moved to small intestine.

4- Small intestine: -

- Long winding tube more than six meters.
- Pancreas and liver pour juices into small intestine.
- It Breaks down food into simple nutrients.
- Complete the digestion and absorb digested food by inner walls.

5- Large intestine: -

- A tube that starts with end of small intestine and end with ***anus.***
- Absorb ***water*** from undigested material so they become solid wastes that come out through anus.

• *To keep the digestive system healthy: -*

1. Chewing food well. 2. Don't eat much fast meals.
3. Drink a lot of water. 4. Practice sports regularly.

Chewing: مضغ saliva: لعاب moisten: يبلل facilitate: يسهل

Swallowing: البلع transfer: ينقل muscular: عضلي pour: يصب

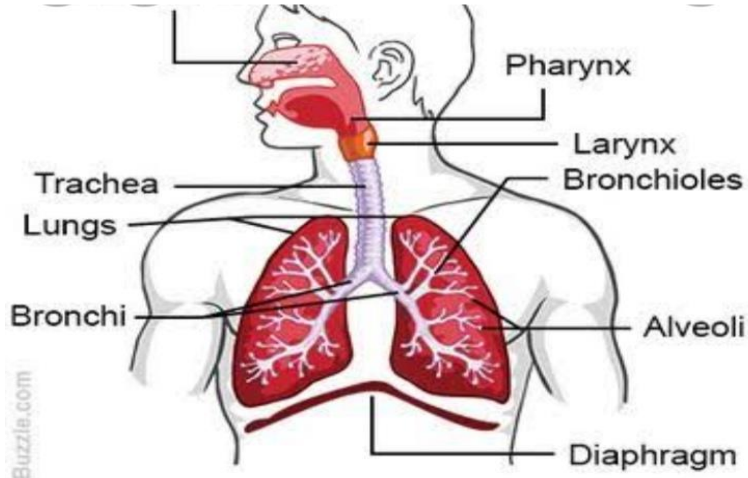
Nutrients: عناصر غذائية practice: يمارس regularly: بانتظام

Respiratory system

- It is the system responsible for ***breathing.***
- It supplies body with **oxygen** gas and gets rid of ***carbon dioxide*** gas.

- **It consists of: -**

    1- **Nose.**
    2- **Throat.**
    3- **Trachea.**
    4- **Two lungs.**
    5- **Diaphragm.**



- ***How respiratory system work?***

1- Air enter the body through **nose** or **mouth** then down to **throat.**
2- air passes through **trachea** into **two lungs.**
3- Trachea is branched into **two bronchi** inside lungs.
4- two bronchi are divided into smaller tubes called **bronchioles.**
5- at the end of each bronchiole, there are **air sacs** **(alveoli)** to extract oxygen from air surrounded by blood vessels.

Respiration process: pulling air with oxygen gas into the body and pushing air with carbon dioxide gas out of the body.

Respiratory system:الجهاز التنفسى supply: يمد get rid of: يتخلص من
Pass: يمر trachea: قصبة هوائية two bronchi: شعبتان هوائيتان
Bronchioles: شعب هوائية air sacs: حويصلات هوائية extract: يستخرج

- We cannot store more oxygen inside our bodies so we must keep take in new oxygen.
- Carbon dioxide is a ***harmful*** gas, so we must expel it out of the body.

- Oxygen enters the lungs during *inhalation* and blood transfer it to all the body.

- Respiration process include ***inhalation*** **a**nd ***exhalation.***

- **Inhalation** and **exhalation** are directed by large muscle at the base of ***ribs*** called ***diaphragm.***

Inhalation	**Exhalation**
Diaphragm ***contract*** and ***moves down.***	Diaphragm ***relax*** and ***moves up.***
Size of chest ***increase.***	Size of chest ***decrease.***
Air rich in ***oxygen.***	Air rich in **carbon dioxide.**

- ***How can we keep respiratory system healthy?***

  1.breathing clear air. 2. Avoid smoking

  3.eating fruits rich in *vitamin C* such as ***orange*** *and* ***guava.***



- ***How fish breath.***

- *Fish can live under water but human not.*
- *Fish have gills to breath instead of lungs in human.*
- *Gills found on both sides of head under bony flaps That can open and close.*
- *Gills considered a …………………adaptation to extract oxygen from water.*
- *As human need clean air also fish need clean water to breath.*

Harmful: ضار expel out: يطرد during: أثناء inhalation: شهيق

Exhalation: زفير contract: ينقبض relax:يرتخى

Ribs: ضلوع avoid: يتجنب gills: خياشيم bony flabs: ألواح عظمية

• Human change the environment.

- There are two types of change according to occurrence time: -

1- *Slow change*, so the organisms have time to adapt over generations.
2- *Rapid change,* so the organism can move, disappear, die or even extinct.

- Changes that occur by nature: -
  1. Change in temperature.
  2. Change in Rainfall amount.
  3. Severe weather (wind).
  4. Wildfire and floods.

- Ecosystem Changes that caused by human activities: -
  1. Cutting down forests.
  2. Clearing grasslands and ***building communities.***
  3. Introducing plants and animals not belong to the ecosystem.
  4. Cars and factories exhausts cause *air pollution.*
  5. Throwing wastes in water (*water pollution).*
  6. Watering soil with polluted water (*soil pollution).*

- Impacts of human activities: -
  1- On animals, they can survive by moving to better place.
  2- Plants, they depend on their seeds to land and grow in suitable place.
  3- On human: -
     - Hard to breath because of air pollution.
     - Hard to find drinking water (water pollution).
     - Crops affected by air, water and soil pollution.
     - Exposure to high level of air pollution for long time can damage the lungs, and cause asthma and heart problems.

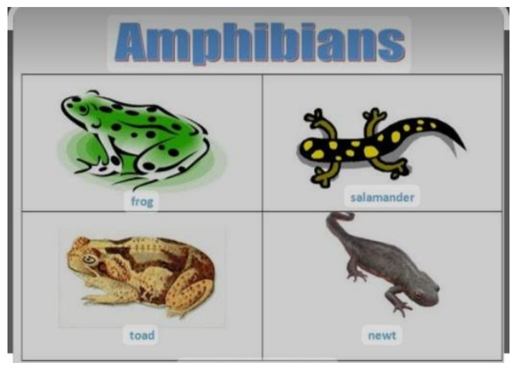
Slow: بطئ	rapid: سريع	impact: تأثير	die: يموت	suitable: مناسب
Disappear: يختفى	extinct: ينقرض	pollution: تلوث	asthma: الربو	
Severe: شديد	plowing: تجريف	exhausts: عوادم		

- **How can we restore the ecosystem?**

  - ***Replanting forests.***
  - ***Removing pollutants from air and water.***
  - ***Preserving animals and plants in their ecosystems.***

- **Amphibians**

- They are small animals such as *frogs*, *toads* and *salamanders*.
- They can live in *moist* environments like *rainforests* and *ponds*.
  - ***Like human, adult amphibians can Breath using lungs.***
  - ***But also they can survive under water Using their skin to extract oxygen.***



- They are very ***sensitive*** to any pollution and there are about 90 species become extinct in last 20 years.
- 124 species of amphibians are *endangered*.

- Amphibians considered as endangered species so we should protect them by ***removing pollutants.***

Restore: يستعيد preserving: حفظ amphibians: برمائيات

Pond: بركة مياه sensitive: حساس endangered:مهدد بالانقراض

Concept two

Senses at work





• ***Senses at work***

❖ Living organisms have senses to *get information* from the surrounding and *communicate* with each other.

Sense.	*Sensory organ.*
Hearing	*Ear*
Sight	*Eye*
Smell	*Nose*
Touch	*Skin*
taste	*Tongue*

- Sometimes, senses become different in strength from animal to another such as: -

1. Owl: has extraordinary hearing and sight.
2. Dog: has extraordinary hearing and smell.

❖ The Egyptian mongoose make sounds to communicate with each other.

Senses: حواس sight: بصر taste: تذوق strength: قوة

Extraordinary: فائق Egyptian mongoose: النمس المصرى

Communicate: يتواصل information: معلومات

• *Dolphin super senses(hearing)*

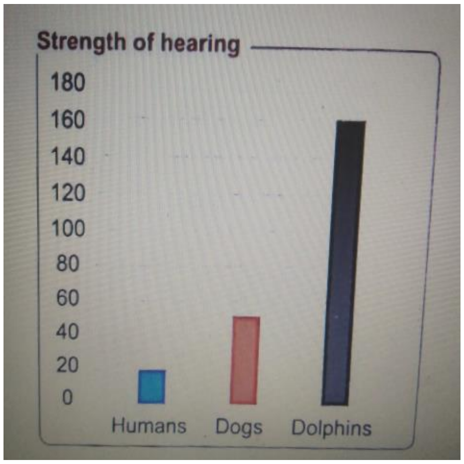
❖ Hearing is very important sense for all organisms.

❖ Sense of hearing help us to gather information from the surrounding environment.

❖ Living organisms are different in their hearing strength.

❖ Dolphins super senses help Them to: -

1- *Survive.*
2- *Search for food.*
3- *Defend themselves.*



❖ Dolphin can hear all sound tones.



Complete the following?

❖ the sharpest sense that dolphin have is …………

important: مهم gather information: يجمع معلومات
survive: ينجو search for: يبحث عن tones: نغمات او ترددات
Sharpest: أحد أو أقوى defend themselves: يدافعوا عن أنفسهم

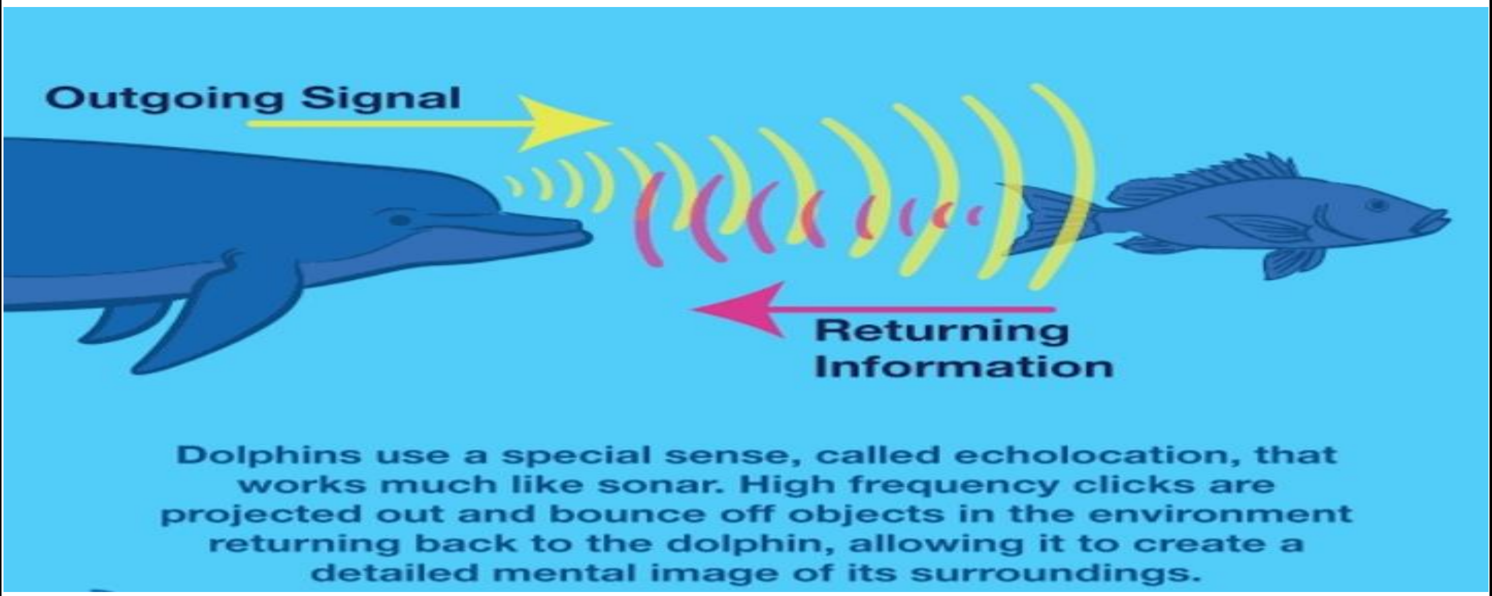
• *dolphin using echolocation: -*

- dolphins depend on (*Echolocation*) to detect location of organisms in water.

Echo: reflecting sound waves back from solid objects to its source

how dolphin use echolocation?

1- Dolphin produce sound waves through water.
2- When sound waves hit any solid object, it reflects back to the dolphin in the form of echo.
3- In this way, dolphin can find its prey.



Use: يستخدم echolocation: خاصية تحديد الموقع بالصدى

Reflects: ينعكس source: مصدر sound waves: موجات صوتية

Solid: صلب form: شكل prey: فريسة in this way: بهذه الطريقة

- ***Examples on animal senses and their purpose: -***

Animal	Sense	Purpose	Example
Fox	Hearing - sight	Avoiding danger	Fox runs away from predators.
Chameleon	Sight - taste	Searching for food	See and taste food.
Dog	Hearing – smell	Recognizing friends	- Used in guarding. - Smell human scent.
Monkey	Five senses	Identifying things	Differentiate between things.

- *Give reason: -*

1- We use dogs for guarding.

……………………………………………………………………………………
……………………………………………………………………………………

Avoiding: تجنب run away: يهرب predator: مفترس purpose: غرض

Used: يستخدم recognize: يتعرف scent: عطر Differentiate: يفرق

Lesson (2): super sensory organs

❖ Human cannot see clearly at night (darkness) but some animals can do called (nocturnal animals).

Nocturnal animals: animals that become active at night.

❖ Why some animals become active at night?

1- Weather is cool during night (in hot regions).
2- Preys available at night only.
3- Use darkness to hide from preys.



1- Bat depend on *echolocation* to move like ....

- It uses the echo to *locate its prey* in the dark.



2- Owls have extraordinary senses of ....&...........

- Owl`s face has:

1. Bowl-shaped face.
2. Special Feathers.

→ G.R

- *To direct distant sounds into ears.*

- So that owl can hear any movement within grass or under snow.

- Owls have *large eyes* that allow them detect any tiny movement.
- Owls can *rotate* their heads in all directions.

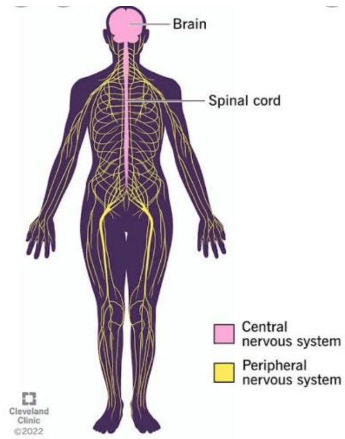
So that they can search for food everywhere easily.

Clearly: بوضوح nocturnal: ليلى available: متاح

Locate: يحدد موقع Bowl: وعاء rotate: يدور

• The nervous system

- There is an ***integrity*** between nervous system and sensory organs. to help the organism collect information from the world.



- ***Mammals*** like human, elephant and dog are similar in the structure of nervous system.

•***Nervous system consists of: -***

1- Brain. **2- spinal cord.** **3- nerves.**

1. **Brain:** the *main control center* of the body.
   - It connected to spinal cord.
2. **Spinal cord**: carry message from **brain** to **body** and vice versa.
   : ***group of nerves that passes through backbone.***
3. **Nerves:** transfer messages from brain to spinal cord through all the body parts and vice versa.
   - the spinal cord connects brain with nerves which are distributed through the whole body.

Some nerves are connected directly to the brain like the nerves of eyes and heart.

- ***Nerves*** connect sensory organs to the brain.
- Sensory organs receive information from environment which transferred by nerves in the form of electrical impulses to the brain to be processed.
- Nerves of sensory organs are called sensory receptors.

Brain: مخ spinal cord: الحبل الشوكى nerves: أعصاب

Main:رئيسى control:تحكم center: مركز backbone: عمود فقرى

Transfer: ينقل connect: يربط أو يصل impulses: نبضات

Processing: معالجة sensory receptors: مستقبلات حسية

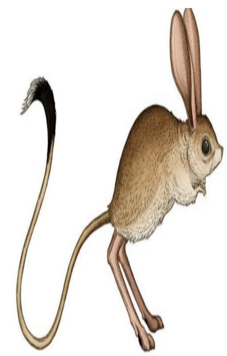
• *Sensing the environment*

- ***Avoiding danger in human and animals: -***

- The parts of nervous system are responsible for sensation and delivering messages.

- Both of human and animals respond to a danger but their reasons are different.

Jumping jerboa



- Egyptian jerboa from *desert rodents*
- Jerboa have: -

1- *long hind legs:* help it jump long distance.

2- *feet and toes have hair*: to catch sand when it run.

3- *large and sensitive ears*: help it to hear any movement.

a) *it hops in a zigzag path:* to run away quickly from danger.

- *Determine the type of adaptation in each point (1,2,3 and 4)?*

Structural (….,….,…..) behavioral (………)

- **All parts of jerboa`s body work together to avoid danger as the following: -**

When a snake makes a noise

1- Sensory receptors in jerboa`s ears send message to the brain through nerves.
2- The brain translates the message and respond by alerting legs to start moving.
3- The jerboa starts moving in a zigzag path using strong hopping legs.

- **The whole response process occurs in less than one second.**

Avoiding: تجنب delivering: توصيل respond: يستجيب

Egyptian jerboa: يربوع مصرى rodents: قوارض hind legs: أرجل خلفية

toes: أصابع zigzag: متعرج occur: يحدث run away: يهرب

- **Reaction time: -**

  -The time taken to react to different information.

  -the time taken to respond to danger.

- **Both human and jerboa depend on *sensory receptors, nerves* and *brain* to respond to danger and move away quickly for their safety.**

- *Lesson 3: Functions of nervous system: -*

  1- Collecting information from inside and outside the body.
  2- Translate the collected information.
  3- Make a response depending on translation.



- *How the nervous system work?*
- *(example)*

1- When you hear someone calling you, sensory receptors of ears send signal to brain.
2- The brain process the sound waves.
3- The brain send signal to body to tell it what to do Such as turning around to know who is calling you.

- Reflexes: very fast messages that we cannot realize it: -

a- Moving your hand away when touching a very *hot cup.*
b- There is an automatic messages sent from brain like signal to breathe.

Reaction: ردّ فعل *depend on: يعتمد على* *translate: يترجم*

Process: يعالج *reflex: رد فعل منعكس* *realize: يدرك*

- *Lesson 4: animal's communication system.*

➢ *Technology help human to communicate through:*
  a- Cell phone.
  b- Text messages and e-mail.

➢ *Animals don't use technology but they can communicate using other systems: -*

- **Ants colony**



- Ants live in ***colonies*** that contain thousands of individuals.
- Ants are divided into groups: -

1- Nurse ants: they send smelly message to scout ants when the food amount is ***low.***

2- Scout ants: they search for food and send smelly message to tell other ants where to find food.

3- Soldier ants: they protect the colony in danger by sending smelly message to alert other ants.

Communication: تواصل	*cell phone: هاتف خلوى*	*colony: مستعمرة*
Nurse ants: عاملات النمل	*scout: مستكشف*	*soldier: جندى*

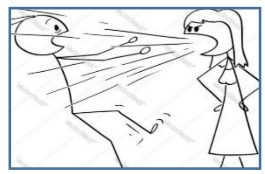
• Humpback whales

- Humpback whales sing under water to communicate with each other.

- They sing a wide range of tones and series of songs.



- ***They sing different songs: -***
    1. During winter (mating season).
    2. During summer.(feeding season)





- ***Sound pitch divided into: -***

    1- High-pitched sound – sharp - soft – like voice of woman.
    2- Low-pitched sound- rough- like voice of man.

- *Humpback whales change their sound pitch according to season as the following: -*

1. In winter, their songs have high-pitched sound.
    - high-pitched sound travels better through cold water.

2. In summer, their songs have low-pitched sound.
    - Because low-pitched sound travels better through warm water.

Humpback whales: حيتان حدباء *sing:* يغنى *mating:* تزاوج

Feeding: تغذية *sound pitch:* درجة الصوت *sharp:* حاد

Technology inspired by nature.

- *Special cane: - used to help blind person.*

1- *It emits high pitched sounds **like bats.***
2- *When sound hit any solid object, it reflects back to the cane.*
3- *The echo turned into vibrations, that sensed by **thump.***
4- *This vibration tells the blind person if there is anything around him.*

- *Human cannot hear sounds that produced from bats and special cane.*

	Special cane	***Bats***
Similarities	- *Both **emit high-pitched** sound that bounce off objects.* - *Both **receive echo** to locate the obstacles*	
Differences	*Turn echo into vibration.*	*Don't turn echo into vibration.*

Special cane: عصا خاصة *vibration: اهتزاز* *thump: ابهام*

Emit: يصدر *receive: يستقبل* *obstacles: عوائق*

Concept three

Light and sight

• Light and sight.

- **Eye** is the organ of sight that is affected by **light** in humans and animals.
    - Humans cannot see in the dark, but they need light to collect information about what happen around them.

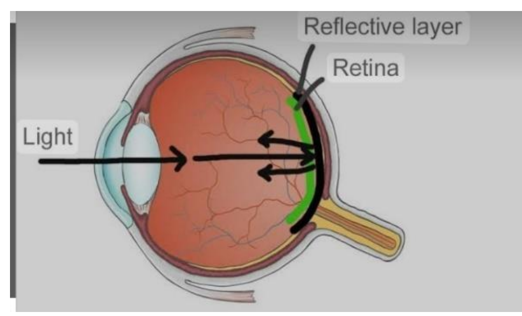


- *Vision in human and animals: -*
- Human eyes need light to see.
- In absence of light we need *night vision goggle.*



➢ Some animals have a structural adaptation in their eyes which help them to see at night such as (fishing cat)

- It's a wild cat hunts during night. (nocturnal)
- Its eyes seem to glow in the dark. G.R?
  due to presence of mirror-like membrane on the back of eye.



- When light enter its eyes, it reflects of this membrane to collect more light.

Affected: يتأثر vision: رؤية goggle: نظارة

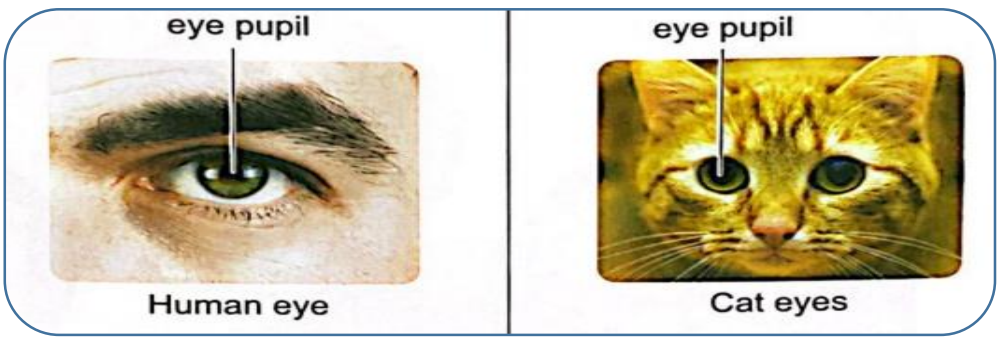
Fishing cat: القط السماك glow: تلمع membrane: غشاء

Reflect: يعكس hunt: يصطاد collect: يجمع

- ***Human and nocturnal animals: -***

1- Nocturnal animals have bigger eyes than human.
2- Eyes of nocturnal animals are more sensitive to light.
3- The pupils of their eyes open wider than human. G.R?
- To allow more light enter their eyes.

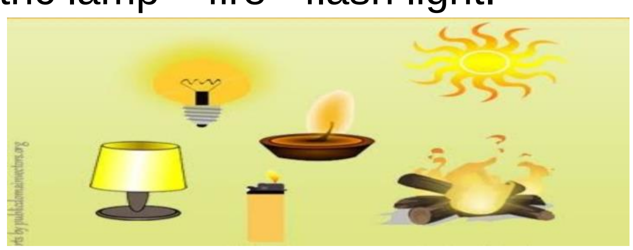
- They can see well in weakest light level.
- In complete darkness, they depend on other senses as hearing and smelling to hunt their preys or avoid their predators.



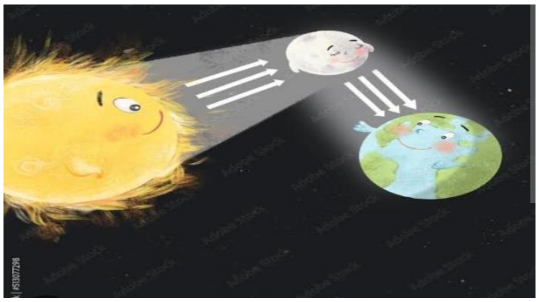
- **Source of light: -**

- It is anything can emit its own light.

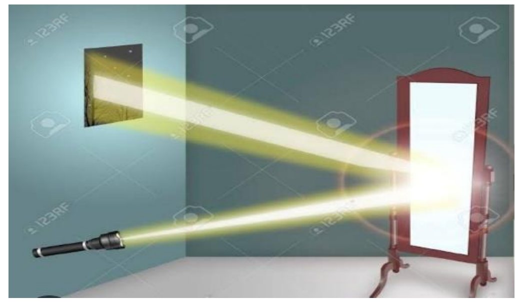
Ex: sun – candle – electric lamp – fire - flash light.



- *Moon* and *mirrors* are not considered as sources of light. G.R?
  - Because they don’t emit their own light but they reflect light.

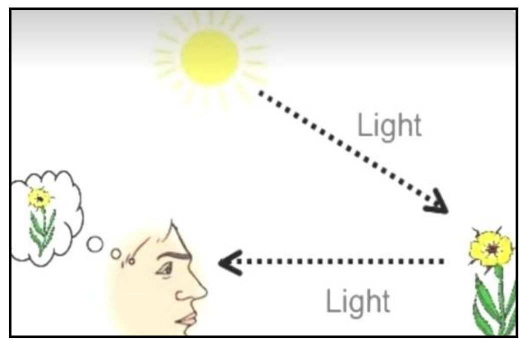


- Moon reflects sunlight.



– mirror reflects flashlight.

- ***How can we see?***



Firstly, we need a light source then:

- Step one: Light rays fall on object.
- Step two: Light rays bounce off object and fall on eyes to see.

- ***Light***: the visible form of energy that travel in the form of ***waves.***

Source: مصدر	emit: يشع او يصدر	fall: يسقط
Rays: أشعة	bounce: ترتد	considered: يعتبر

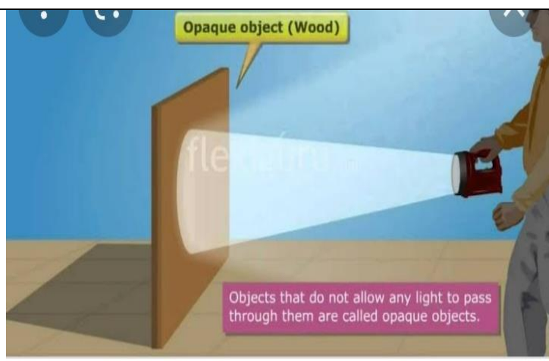
- ***Reflection of light:***
  - ***Returning back of light when it meets a reflecting surface.***

Type of material.	**Shiny and smooth.**	**Rough.**	**Transparent.**
Example	Metals and mirror	Plastic, wood, cloth and paper.	Glass.
Amount of reflected light rays.	Large amount.	Small amount.	Very small amount.

- ***Light strike matter: -***
  - Light is a form of energy that always travels in a straight line.
  - Light travels in the form of waves.

- The behavior of light waves changed according to the type of matter. when light hits an object: -
  - Some of light is absorbed.
  - Some of light may pass through it.
  - Some of light reflects off surface.

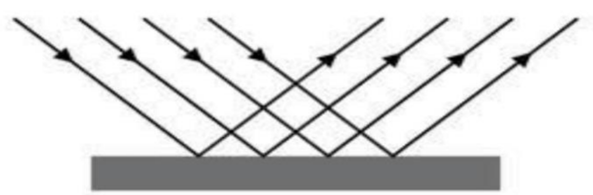
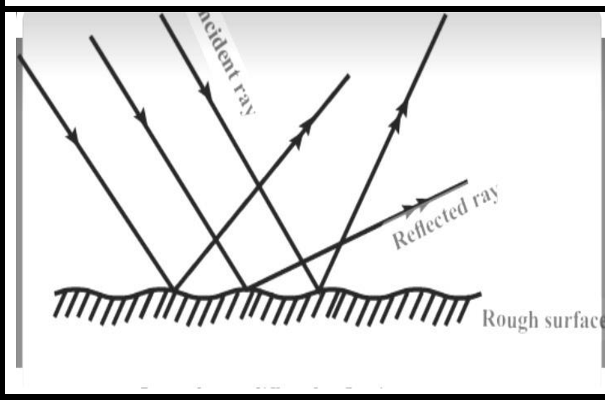
Reflection: انعكاس meet: يقابل shiny: لامع
Transparent: شفاف straight: مستقيم waves: موجات

Opaque materials.	**Transparent materials.**
- Materials that *don't allow* light pass through it.	- Materials that *allow* light pass through it.
- Objects ***cannot be seen*** through them.	- Objects ***can be seen*** through them.
- Plastic – wood – metals- human body.	- Air – water- windows –lenses
- They form shadows in presence of light.	- They don't form shadows.
- 	

- **<u>Shadow:</u>** dark area formed behind opaque materials.

Strike: يصدم always: دائما straight line: خط مستقيم
Waves: موجات pass: يمر absorbed: تمتص shadow: ظل
Opaque: معتم form: يكون behind: خلف

- Reflection of light depends on the smoothness of surface: -

Polished (smooth) surface.	Painted (rough)surface.
- Reflect light in one direction. (the same angle).	- Reflect light in different directions.
	

- Rough surfaces scatter or diffuse light.

Depend on: يعتمد على smoothness: نعومة polished: مصقول

Scatter: يشتت diffuse: يفرق angle: زاوية direction: اتجاه

• Less. 3: Firefly light show.

• Fireflies beetles: -

- They are small insects that can light up.
- Their light wings due to chemical reaction occur inside their bodies.
- They flash at regular periods of time.



- They use their wings to flash to: -
  1. Warn off other beetles from predators.
  2. Attract a mate to reproduce.

- Each group of fireflies beetles have their own flash pattern.

- To communicate with other group, they change their pattern to be matching with the other group pattern.

- human use light to communicate such as traffic lights.

Human	***Animals***	***Both of them.***
1. Reading 2. Writing 3. Watching T.V. 4. Cell phone 5. Electronic reader.	• Echolocation	1. High and low pitched sounds. 2. Lights. 3. Movements.

Firefly beetles: خنافس مضيئة chemical reaction: تفاعل كيميائى

Wings: اجنحة occur: يحدث regular: منتظم warn off: يحذر

Attract: يجذب mate: شريك للتزاوج

pattern: نمط flash: وميض respond: يستجيب

Lesson 4: transferring information

- Eyes depend on the light energy to collect information from the surrounding environment.

Eyes can detect and understand different signals: -



1. Someone waving at you.
2. When you see a red traffic light, your eyes send message to stop.





3. people use rescue flare to communicate.
4. People use fire to send signals over very long distance.
5. Many travelers use mirror (light reflecting surface) to send signal to get help.



waving you: يلوح لك

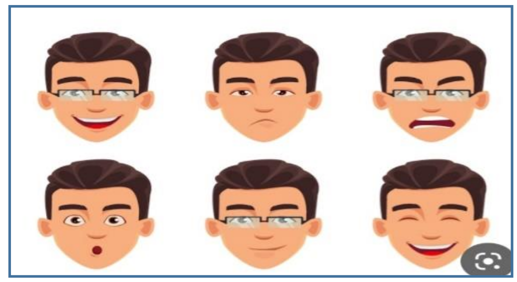
rescue flare: شعلة انقاذ

travelers: مسافرون

- ***Code: -***
  - ***It is a pattern that has meaning.***
- *It's an information that transformed into another form:*

1- Thump up. (good)
2- Thump down. (bad)

3- Traffic lights.



4- Expressions of your face.

5- Language: code in the form of sound.

6- Writing: using letters to transmit information

(the meaning depend on the arrangement of letters in the word).

7- music(sounds): can be used in communication.

8- Lighthouses: send codes in the form of light to tell Sailors where they are.



- The brain can decode and interpret the meaning of received code.

Thump: ابهام expression: تعبير decode: يحل شفرة Interpret: يفسر

Unit 2
Starting and stopping





science is simple

With Mr. Mohamed El-Sadany

01009887293

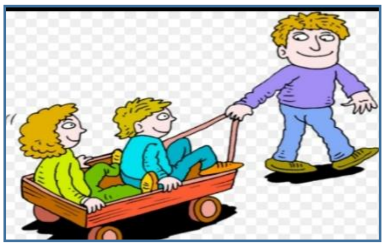
Moving and static objects

- *To stop moving object or move static one, we need* ***a force.***

- ***Force may be:***

  1- ***Pushing force****: moving objects away from you.*
  2- ***Pulling force****: moving objects toward you.*

- lock at the following and determine the type of force: -





…………………… ……………………... ………………..

- ***Truck & jet airplane: -***
  1- Jet airplane fly much faster than truck. G.R?
     - Because the engine of jet airplane is stronger than the engine of truck.



- ***Shock wave truck: -***
  a- It is a truck fitted with ***three*** *jet engines.*
  b- Its speed reach ***500*** *kilometer per hour.*
  c- It is ***five times*** *faster than normal truck.*

Moving: متحرك static: ساكن force: قوة

Pushing: دفع *pulling:* سحب أو شد *truck:* شاحنة

Jet airplane: طائرة نفاثة *engine:* محرك *fitted with:* مزودة ب

Reach: تصل إلى *five times:* خمس مرات

- ***Stopping shockwave truck: -***



- *The idea of stopping shockwave truck is **the same** idea that used in **rockets.***
- *Engineers supply it with **three parachutes.***
- *The driver opens parachutes to slow down the truck quickly.*

- ***Moving objects: -***

  - ***Any object around us cannot move without force (push or pull).***

- ***Air can move the leaves of tree by the wind blowing.***



A cart with fire extinguishers

- *Some engineers fix fire extinguishers onto a cart.*
- *The air moves backward so the cart start to move forward.*

- *What happen if we increase the number of extinguishers?*

1. *The speed of cart will increase.*
2. *The distance that cart move will increase.*

Idea: فكرة *rockets:*صواريخ *supply:* يمد ب

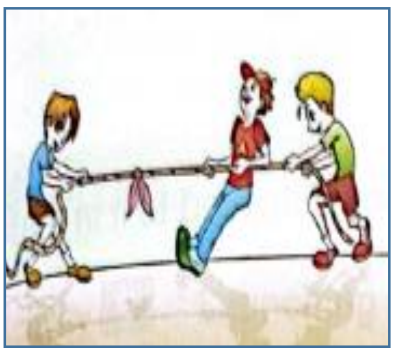
Parachutes: مظلات *slow down:* يبطئ *without:* بدون

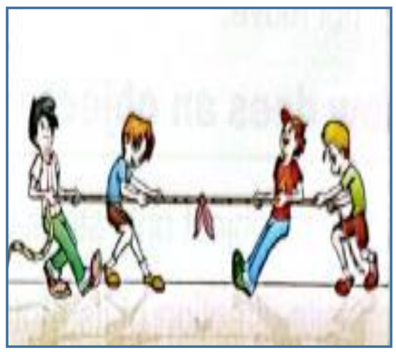
Fix: يثبت *backward:* للخلف *forward:* للأمام

Fire extinguisher: مطفأة حريق *increase:* تزداد

- ***Balanced force: -***
  - *When two equal forces act on the body in different directions.*
  - *The object will not move.*

- ***Unbalanced force: -***
  - *When two unequal forces act on the body in different directions.*
  - *The object will move toward the stronger(greater) force.*







Type: ………..... …………..... ……………....

Direction: ………… ……………. …………….

balanced: متوازن *unbalanced: غير متوازن* *toward: تجاه*

motion: *change in the position of object relative to fixed point.*



- ***Explanation of motion: -***

1- If you are playing football with your friend.

2- The starting position of ball is ***close*** *to tree.*

3- The ball starts to move away from the tree due to the ***pushing force*** *of your hand.*

4- The ball will drop into your friend`s hand due to the ***pulling force*** *of* ***gravity.***

5- The ball will ***stop*** *due to* ***pushing force*** *of Your friend`s hand.*

- ***We can say that the ball in state of motion. G.R?***
  - *Because its position changes relative to the tree.*

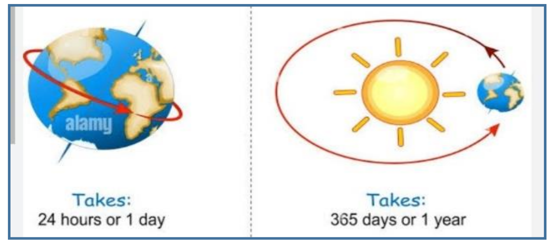
Gravity: the force that pulls objects toward the earth.

Motion: حركة *position:* موضع *relative to:* بالنسبة ل
Close to: قريب من *move away:* يبتعد عن *gravity:* جاذبية





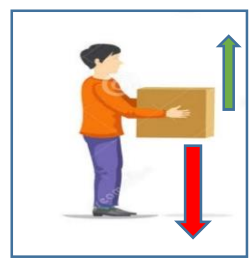
- ***Visible motion (easy to see): -***
  1. ***Walking person.***
  2. ***Moving cars.***
  3. ***Ball movement.***



- ***Some motion is hard to see: -***
  1. ***Rotation of earth around sun.***

- ***Force***

Force: pull or push that act on object to change its position.



- When you are lifting a bag: -

  The bag is affected by to forces: -
  1. Pulling force of gravity. (downward)
  2. Pulling force of your arm. (upward)



- When you are sitting: -
  - force of gravity is pulling you downward to hold you in the chair.

Visible: مرئى lift: يرفع sitting: جالس

• *Stopping motion*

➢ To stop moving object: -

- Force of the *same amount* act on the object
- in *opposite* direction of its motion.



- ***We can observe stopping force easily: -***

  1- When car crashes into a wall.

  2- The car will stop. G.R?

  - Because the wall applied force on the car equal to the force that move the car.

- ***Sometimes it will be hard to observe stopping force: -***

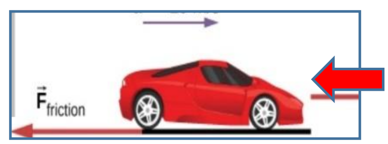
  1- When the car runs out of fuel.

  2- Its speed decreases gradually until it stops G.R?

  - Due to the **friction force** between: -

    1- Car tires and road.

    2- Air and the car



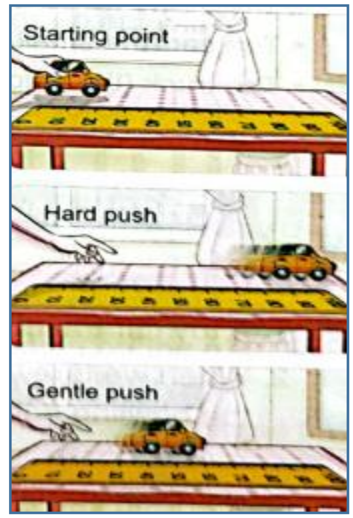
Friction: *it is the force that arises when objects rub against each other.*

*1- Friction **slows down** or **stop** moving objects.*

*2- Friction force is always **opposite to** the direction of motion.*

Crash: يصطدم gradually: تدريجيا friction: احتكاك tires: اطارات

- ***Lesson 4: Rolling cars***



- *If you push a toy car **hardly.***
  - *It will move **long** distance.*

- *If you push a toy car **gently.***
  - *It will move **short (small)** distance.*

- ***If the same force act on two objects (car and truck): -***

  *1- The object that has **smaller** mass (car) will travel for **long** distance.*

  *2- The object that has **bigger** mass (truck) will travel for **short** distance.*





Hardly: بقوة gently: برفق travel: يتحرك أو يسير act on: يؤثر على

• *Lesson 5: energy, force and work.*

- To stop or move object, we need a force.
- To apply force to object, we need an energy.



- When you push a car: -
  1- Energy transfer from your body to the car.
  2- If the car moved, you do work.

So that: -

1- The force transfer energy from one object to another.
2- The work done is equal to the amount of transferred energy.

force → ***transfer*** → ***Energy*** → ***Enable us to do*** → ***work***

- *Force and energy are **<u>different</u>** but related to each other.*
- *Force is the effect that transfer **<u>energy</u>** and convert it into **<u>work.</u>***

Transfer: تنتقل   work: شغل   effect: تأثير   Convert: يحول

- ***Concept 2.2: Energy and motion***

- Any moving object has ***kinetic energy.***

- Static objects don't have kinetic energy but they may have ***potential energy.***

• *Roller coasters*

- ***There are three states: -***

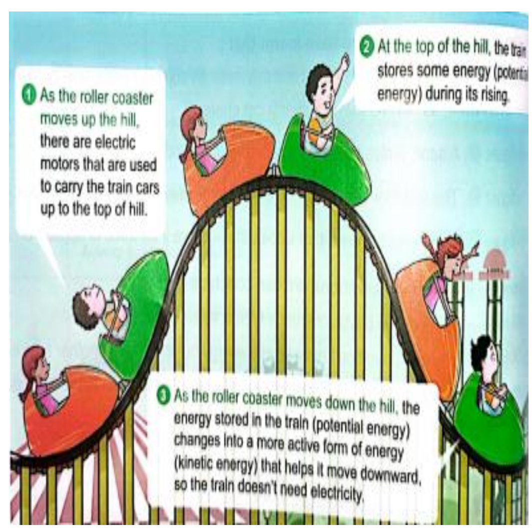
1-On moving up, the roller coaster depend on electric motor till the top of ramp.

2-At the top of ramp, the roller coaster stores **potential** energy.

3-On moving down, the roller coaster don't need electricity. G.R?

- Because potential energy is converted into kinetic energy.

- Kinetic energy increases by increasing its speed.



1-What happens if roller coaster stops?

- Its kinetic energy become zero.

2-What happens if roller coaster moves upward?

- Kinetic energy changed into potential.

3-What happen if roller coaster moves downward?

- Potential energy changed into kinetic.

Kinetic energy: طاقة حركة potential energy: طاقة وضع

Ramp: منحدر roller coaster: قطار الملاهى السريع top: قمة

- ***Lesson 2: - energy***

- ***Importance of energy: -***

1-We get energy from food to help us ***grow*** and ***move.***
2-Energy ***affects*** the objects and change their ***positions.***
3-***Operating*** all electric devices need electric energy.
4-Heat energy helps in ***cooking.***
5-Lighting houses and streets.

- ***Transferring (moving) energy: -***

- *Energy can transfer from one object to another as the following: -*

1- ***When the player kicks the ball.***
   - Kinetic energy transfers from his foot to the ball.

2- ***Then the ball starts to move in the air. G.R?***
   - Due to transferring of kinetic energy to it.

3- ***When the ball gets inside the goal.***
   - Kinetic energy will transfer from the ball to the goal net.

4- ***The goal net will vibrate. G.R?***
   - Due to transferring of kinetic energy to it.

Affect : يؤثر operating: تشغيل transfer: تنتقل kick: يركل

Goal net: شبكة المرمى due to: بسبب lighting: إضاءة

- ***Energy inside stopped (static) object: -***

1- When the static object is on the ground.
   - It has no potential energy.

2- When the static object is at height from the ground.
   - It has potential energy.

- ***Energy: -** it is the ability to do work or make change.*
- ***Work: -**it is the force that make object move a distance.*

Some facts: -

1- Energy can be stored and change from one form to another.

2- Most of energy forms cannot be seen.
- ***Sound – electric – thermal – chemical***

3- We cannot see most of energies but we can see and measure the effect of energy.

4- We cannot see sound, electric, thermal and chemical energies.

Height: ارتفاع stopped: متوقف ability: قدرة distance: مسافة

Facts: حقائق store: يخزن thermal energy: طاقة حرارية

- ***Potential energy: {P.E}***
  - *It is the energy stored inside object due to its position.*

- ***Kinetic energy: {K.E} –*** *the energy of object due to its motion.*
  - *It is the energy that produced from object motion.*

➢ *Potential energy can change into kinetic energy and vice versa.*



1- *The boy on a tower has* ***potential*** *energy.*



2- *When he jumps down,* ***P.E*** *converted into* ***K.E***



3- *K.E transfer from boy to girl, and she pushed up into air.*



4- During moving upward, ***K.E*** is converted into ***P.E***

- Object that has potential energy is ready to do work or to be active.

Stored: مختزنة   produced: ناتجة   motion: حركة   pushed up: تدفع لأعلى

Transfer: تنتقل   converted: تتحول   ready: على استعداد

- Lesson 3

- ***Forms of potential energy: -***

1- Gravitational potential energy. (roller coaster)
2- Chemical potential. (battery)
3- Elastic potential. (compressed spring)

- *Factors affecting potential energy: -*

1- Mass of object.
2- Height from the ground.

There is a direct relation between the potential energy and the mass &height of the object.

- ***Forms of kinetic energy: -***

1- Sound. Sound waves move in air.
2- Light. Light waves move in air.
3- Electrical. Electric moves through wires.
4- Thermal. Particles of substance vibrate on heating.

Battery: بطارية compressed: مضغوط direct relation: علاقة طردية

Height: ارتفاع wires: أسلاك vibrate: تهتز

- Energy can be ***transferred*** from on object to another.
  Ex: when you kick the ball.

- Energy can be ***transformed*** from one form to another.

Ex:

Device	Energy change From	to
1- Flashlight	**Chemical** that stored in battery.	Light and heat.
2- Gas oven	**Chemical** that stored in natural gas.	Thermal.
3- Spring powered toy car.	**Potential** stored in spring.	Kinetic, sound and thermal.
4- Real car.	**Chemical** energy in gasoline.	Kinetic energy.

- *Energy stored in many forms.*
- *new energy cannot be created, and existing energy cannot be destroyed.*
- *Food store chemical energy.*

Kick: يركل battery: بطارية natural gas: غاز طبيعى

Spring: زنبرك gasoline: بنزين

- Easy life tool.



Tool name: robot hand.

Function: used to open jar cap

Source of energy: battery.

Chemical energy stored in battery. → Converted → Electric energy in the robot hand. → Converted → Kinetic energy on moving hand.

Robot: انسان الى

jar cap: غطاء إناء

Energy and collision

- when two objects *collide with* (hit) each other, we can observe that: -

energy

1- transfered

2- changed



Object		Result
Faster and heavier object	→	- Has more energy. - Cause more damage.
Slower and lighter object	→	- Has less energy. - Cause less damage.

Collision : تصادم collide with : يصطدم ب observe : يشاهد transferred : تنتقل

Change : تتغير او تتحول damage : ضرر او تلف lighter : اخف وزنا

Wrecking ball



wrecking ball : very heavy steel ball that swing on a cable .
wrecking ball used to destroy buildings (depend on collision).



remember that: *Energy can transfer from object to another.*

Cricket game



- Cricket is a popular game; the player uses a wooden bat to hit the ball.
  - When a player hit the ball: -
    1. Kinetic energy transfers from bat to ball.
    2. Ball speed increase and its direction change.
    3. Some energy change into sound as (popping).

- **What happens when moving car stop suddenly and why?**
  - Passengers body continue to move forward.

Because → Body in state of motion stay moving until some force act on it.

Wrecking ball: كرة التحطيم   swing: تتأرجح   popular: شائع   bat: مضرب

Popping: (صوت ناتج عن التصادم) فرقعة   suddenly : فجأة   continue : يستمر

Forward: للأمام   state of motion: حالة حركة   act on: تؤثر علي

Safety equipment in cars

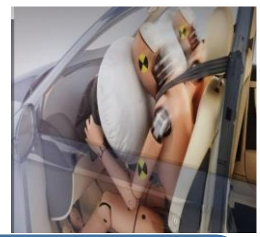


1) Seatbelts : used to keep driver and passengers bodies from moving forward when the car stop suddenly.

G.R : seatbelts saved thousands of lives. (answer above)

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2) ***Airbags*** : made up from thin, nylon material.



1. Found folded into steering wheel , seats, dash board or doors .

Idea of operation:- فكرة عمل الوسادة الهوائية

-Modern cars contain sensor that can detect the crash.
-During collision, sensor make airbag inflate very fast and filled with gas to protect the passenger.
- After collision, airbag deflate due to vents in it .



❖ ***Importance of airbags : -***

1. Absorb the energy of collision (make it soft).
2. Save many lives during accidents.



Collision between car and train.



- **Train will make more damage for car. G.R?**
  Because train is heavier and faster.

Safety equipment : معدات أمان seatbelt : حزام أمان save : ينقذ airbag : وسادة هوائية

Passenger: راكب steering wheel: عجلة القيادة folded : مطوية inflate : تنتفخ deflate : تفرغ من الهواء

Vents : ثقوب importance : أهمية absorb : تمتص sensor : حساس

Lesson 2 : energy and collision

We learned that during collision energy is *transferred* and *changed*.

Collision: time when two objects hit each other.



(collision of billiard-ball)

- ***Now, let's see what happen when moving ball collide with another static one: -***

1. *Kinetic energy **transfers** from moving to static ball.*
2. *Some of kinetic energy **changed** into sound and Heat energy.*
3. *Moving ball will **stop**, and static ball start to **move**.*

- ***By the same way we can explain the energy transformation during collision.***

Static: (لا يتحرك) ساكن billiard ball : كرة البلياردو exert : يبذل force : قوة

By the same way: بنفس الطريقة during: اثناء

- ***Basics of speed: -***

$$Speed = distance \div time = \frac{distance}{time}$$

Speed: the distance covered in a certain time.

measuring units of speed	• kilometer per hour (kph - k/hr). • meter per second (m/s).
factors required to know the speed.	• distance . • time .

Problems

1. Saged buy new car that can travel *5 meters* in 5 seconds, calculate the speed of the car?

   Speed= $\frac{\dots\dots\dots}{\dots\dots\dots}$ = $\frac{\dots\dots}{\dots\dots}$ = ………… m/s.

2. Mohamed take ***2 hours*** to reach his school calculate the speed if you know that the distance he covered =***10 kilometers.***

   Speed= $\frac{\dots\dots\dots}{\dots\dots\dots}$ = $\frac{\dots\dots}{\dots\dots}$ = ………… kph.

factors: عوامل required:مطلوب reach: يصل إلى

- **Comparing speed of two moving objects**: -

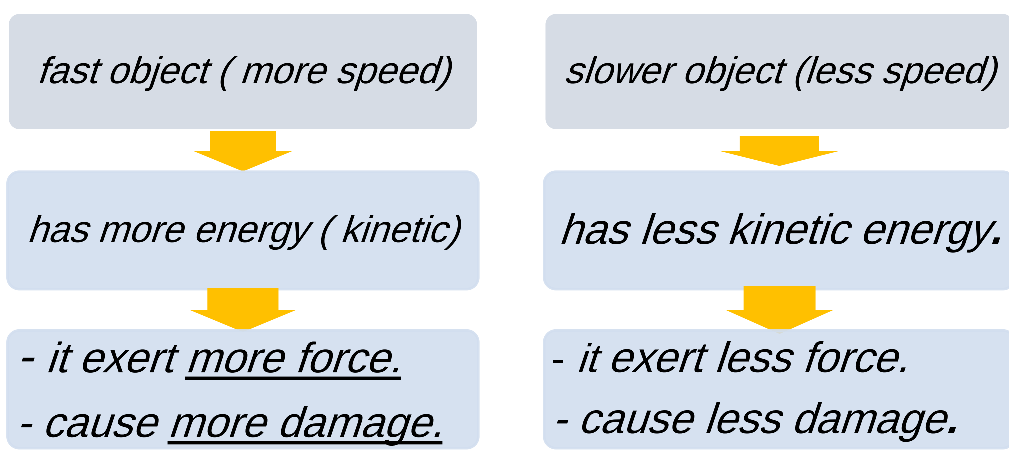
1-If two moving objects move at <u>equal periods of time</u>: -

- The object which cover ***<u>longer</u>*** distance is ***<u>faster</u>*** ***(has greater speed)*** than other object that cover shorter distance.

2-***If two moving object cover the <u>same amount of distance: -</u>***

- The object which travel the same distance in ***<u>smaller</u>*** amount of time is ***<u>faster</u>*** than other object which take more time.

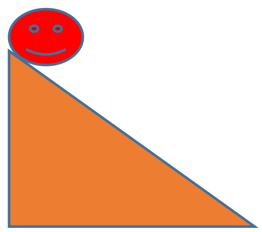
- ***Effect of speed on collision: -***



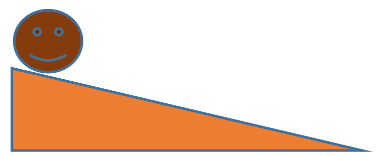
G.R: driving fast is very dangerous?

……………………………………………………………………………

As angle of inclination increase → speed will increase → kinetic energy increase



(A)



(B)

- the body in figure (A) will move faster and has more kinetic energy so it will move longer distance.
- when large force act on object → its speed will increase.

- ***Kinetic energy depends on: -***

  1- Mass.
  2- Speed.

Angle: زاوية ***inclination: انحدار او ميل*** ***kph: كيلو متر في الساعة***

Speed: سرعة ***kinetic energy: طاقة الحركة*** ***increase: تزداد***

decrease: تقل

- ***Effect of direction during collision: -***





Opposite direction.

More damage

The same direction.

less damage

G.R: we should keep distance from cars during driving.

- To avoid accident.

Complete the following:

1.Kinetic energy of the body depend on ………………..and ………………………

2. if speed of object increase, its kinetic energy ……………………..

3. force of collision depend on ………………… of both cars.

4. collision of two cars move in opposite direction cause……………..damage
   Than collision of two cars move in one direction.

Effect: تأثير **opposite:** مقابل او معاكس **the same direction:** نفس الاتجاه **avoid:** تجنب

Depend on: يعتمد علي **Damage:** ضرر

Lesson 3 : speed and collision

As we learned in previous lessons: -

As the force acting on object increase, its speed will increase.
So its kinetic energy increase also.

- ***What happen If you have a clay ball and threw it: -***
  - the amount of deformation depends on the force acting on the ball.
  - When you let the ball without pushing, its shape change slightly.
  - While let ball with pushing, cause more change in shape.

Relation between mass and kinetic energy





- **Small mass**
- **Small engine**
- **Consume less fuel.**
- **Less kinetic energy.**

- **large mass**
- **big engine**
- **Consume more fuel.**
- **More kinetic energy.**

Clay ball : كرة طينية deformation : تغيير الشكل /تشوه slightly : قليلا shape : شكل

Relation : علاقة engine : محرك consume : يستهلك

Remember that

- ***Kinetic energy depends on <u>speed</u> and <u>mass</u>.***

If two objects have the same speed, the energy will depend on <u>mass</u> only.

<u>What happen when bicycle and car move at the same speed and hit somebody</u>?

- Car will cause <u>more injuries</u> due to its <u>big mass</u> (more energy).
- Bicycle will cause <u>less injuries</u> due to its <u>small mass</u>(less energy).





<u>Complete the following : -</u>

1. Car accident cause ………………….injuries than bicycle accident.
2. When mass of object increase, its kinetic energy ………………….
3. Large truck uses ………….amount of fuel .

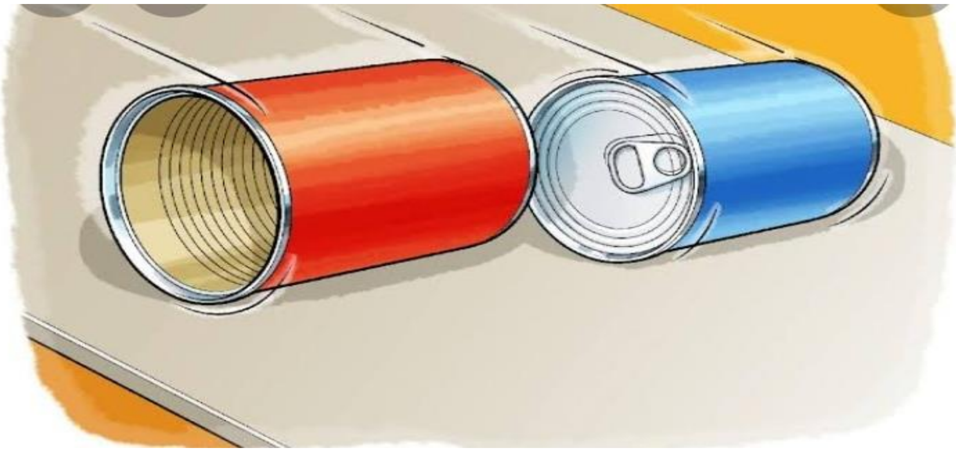
<u>G.R: large objects hurt more than small one.</u>

………………………………………………………………………………………………

Injuries: جروح accident: حادث

hurt : يؤلم only : فقط

Lesson 4 : mass and collision



- By increasing the mass of object on a ramp, its speed will increase.
- By increasing speed of object, its kinetic energy ………….
- Larger object (big mass) has more energy so, it can make powerful collision.
- Smaller object (small mas) has less energy so, it makes a weak collision.

Speed and kinetic energy for object on a ramp depend on

1.Angle of inclination.

2.Mass of object.

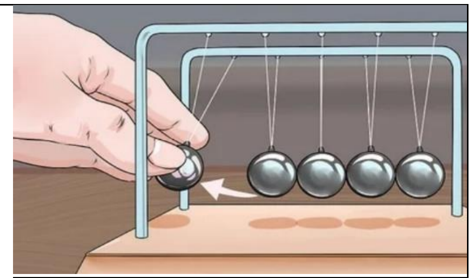
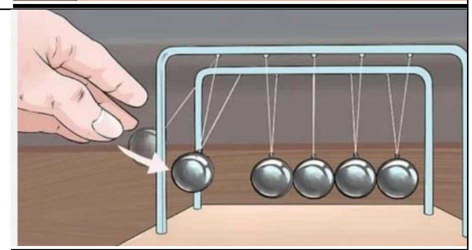
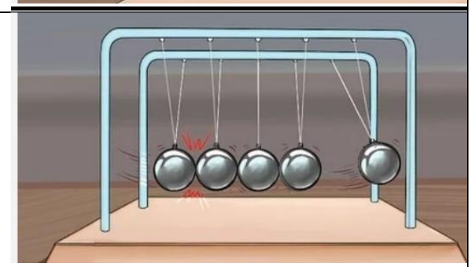
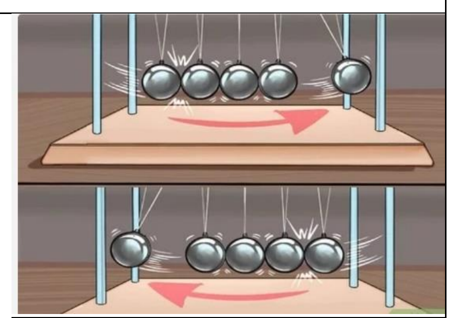
By increasing angle of ramp, the speed of object ………….
By decreasing mass of object, the energy will………………

Mass: كتلة **ramp :** منحدر **powerful :** قوى **weak :** ضعيف **angle :** زاوية

Inclination: ميل **increasing:** زيادة **decreasing:** تقليل او نقصان

Lesson 5: transformation of energy during collision

- **Newton cradle:-**

When you hold ball as figure: - -***The ball*** 1. store most potential energy 2. has no kinetic energy (static)	
When you let the ball move: - potential energy ***changes*** into kinetic energy. ***1- potential decrease*** ***2- kinetic increase***	
During collision: - - Energy *transferred* gradually from each ball to the next one. - Number of balls on both sides is equal.	
Eventually: - - some energy changes into *sound* and *thermal* energy. - some energy lost due to friction between balls and string& (friction between balls with air)	

- After a lot of collisions, balls will stop. ***G.R?***
  because part of energy lost in friction between balls and air.

- *Energy is conserved during collision (cannot be destroyed)*
- *The amount of energy before collision = the amount of energy after collision.*

Hold : يمسك   let : يترك   changes into : تتحول الى   eventually : اخيرا

Thermal : حرارى   lost : مفقوده   potential energy : طاقة وضع